OCCASIONAL PAPERS OF THE
FARLOW HERBARIUM OF CRYPTOGAMIC BOTANY

HARVARD UNIVERSITY, CAMBRIDGE, MASSACHUSETTS

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Stereocaulon sterile (Sav.) M. Lamb and *Stereocaulon groenlandicum* (Dahl) M. Lamb, Two More Hitherto Overlooked Lichen Species

I. Mackenzie Lamb

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No. 1. Sylvia A. Earle: *Hummbrella,* a New Red Alga of Uncertain Taxonomic Position from the Juan Fernandez Islands (June 1969).

No. 2. I. Mackenzie Lamb: *Stereocaulon arenarium* (Sav.) M. Lamb, a Hitherto Overlooked Boreal-Arctic Lichen (June 1972).

No. 3. Sylvia A. Earle and Joyce Redemsky Young: *Siphonoclathrus,* a New Genus of Chlorophyta (Siphonales: Codiaceae) from Panama (July 1972).

No. 4. I. Mackenzie Lamb, William A. Weber, H. Martin Jahns, Siegfried Huneck: *Calathaspis,* a New Genus of the Lichen Family Cladoniaceae (July 1972).

No. 5. I. Mackenzie Lamb: *Stereocaulon sterile* (Sav.) M. Lamb and *Stereocaulon groenlandicum* (Dahl) M. Lamb, Two More Hitherto Overlooked Lichen Species (March 1973).

STEREOCAULON STERILE (SAV.) M. LAMB AND *STEREOCAULON GROENLANDICUM* (DAHL) M. LAMB, TWO MORE HITHERTO OVERLOOKED LICHEN SPECIES

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Summary

Stereocaulon sterile and *Stereocaulon groenlandicum,* originally described as a form of *St. evolutum* and a variety of *St. rivulorum* respectively, are shown to be distinct species. The former has an amphipacific distribution areal (mostly in western North America), while the latter appears to be circumpolar boreal-arctic. *St. groenlandicum* contains a combination of lichen substances unusual for the genus (perlatolic, miriquidic and anziaic acids, in addition to atranorin).

Introduction

The following two *Stereocaula* were originally described as infraspecific taxa, but detailed studies have shown them to be entitled to the status of independent species. The first of them (*St. sterile*) was already mentioned in a previous publication in this series (Lamb, May 1972).

Stereocaulon sterile (Sav.) M. Lamb ex Krog, 1968, p. 89.

Syn. *St. evolutum* f. *sterile* Savicz, 1923, p. 165.

Lectotype material: U.S.S.R., Kamtchatka, Truby Volcano near Sel'dëvaya Bucht, coll. V. P. Savicz, 1908 (no. 2263), in Herb. Bot. Inst. Acad. Sci. USSR, Leningrad (LE).

A saxicolous species of northern amphipacific distribution (Fig. 1), belonging to subgen. *Stereocaulon,* sect. *Stereocaulon,* morphologically resembling *St. subcoralloides* Nyl. and *St. tennesseense* H. Magn., and in certain states also *St. evolutum* Graewe, but differing from the latter in the shape and dimensions of the spores; containing atranorin and lobaric acid.

Figs. 2-7 (habitus).

Forming pulvinate-caespitose, pale gray clumps 2-5 cm diam., 1-2 cm high, firmly attached to rock or to detritus in rock-crevices; younger clumps flattened, compact and dorsiventral, resembling *St. evolutum* Graewe, older clumps with looser and more erect, intricated pseudopodetia. *Pseudopodetia* often ± rigid and ligneous, sometimes as much so as those of *St. botryosum* Ach. emend. Frey, 1.0-2.5 cm long, naked,

decorticate, glabrous, terete or only slightly flattened, often blackening and with root-like holdfasts at the base, (0.5-) 1.0-1.5 mm thick, irregularly branched from near the base and upwards; numerous pseudopodetia

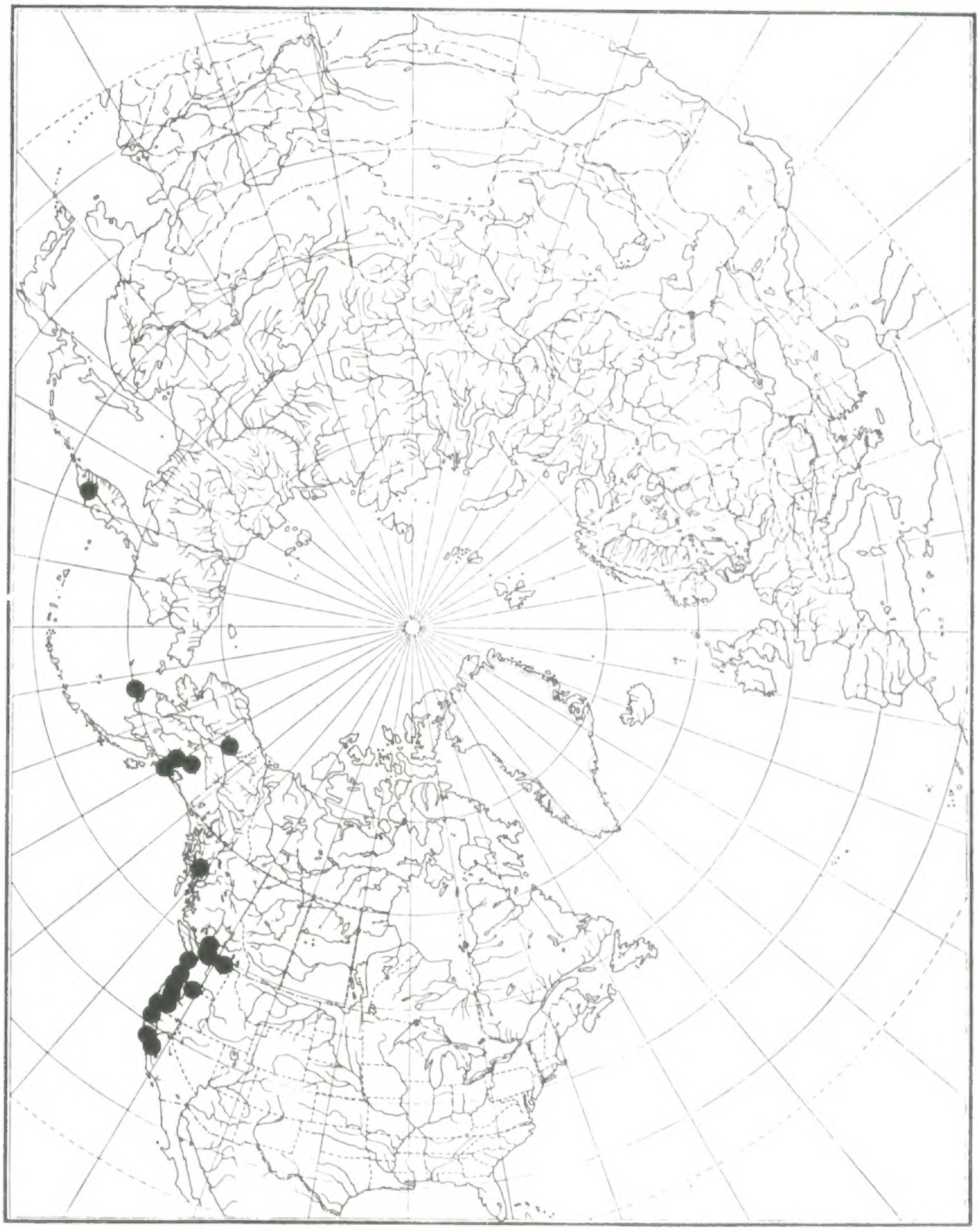


FIG. 1. Known distribution of *Stereocaulon sterile* (Sav.) M. Lamb.

springing from a common, ± wide holdfast area. In younger clumps of dorsiventral habitus the pseudopodetia are well visible only on the underside, the upper side being ± covered by a concealing crust of phyllocladia. *Phyllocladia* at first (in young clumps) digitate-squamu-

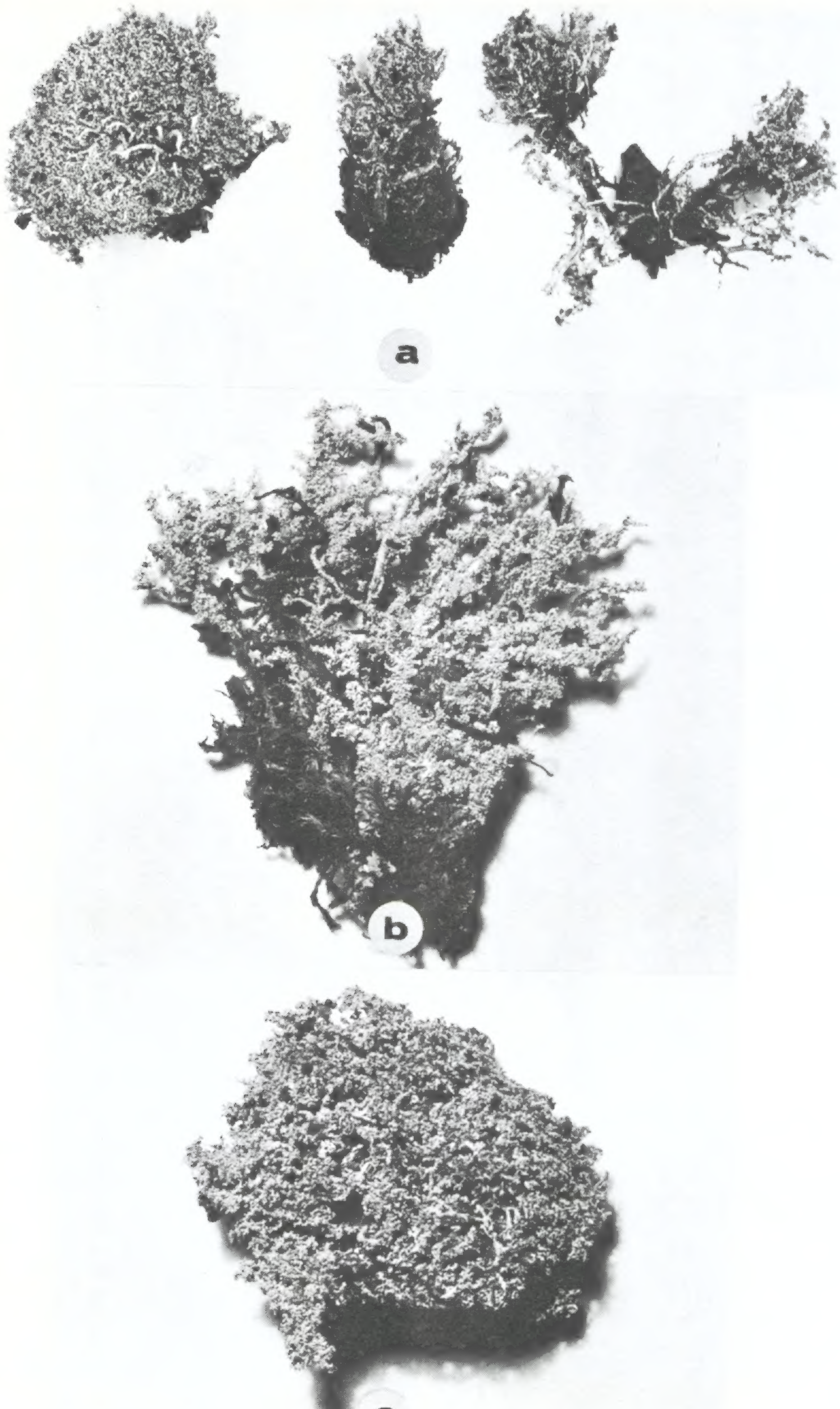


FIG. 2. *Stereocaulon sterile* (Sav.) M. Lamb. a: a specimen from U.S.A., Oregon (Lamb no. 7750). b: a specimen from U.S.A., Oregon (Pike no. 1381). c: a more compact specimen from U.S.A., Oregon (Lamb no. 7854). × 1.

lose, whitish, ca. 1 mm long and up to 0.5 mm broad, resembling those of *St. evolutum* Graewe, the lobes not paler at the tips; later (in older clumps) becoming ± terete and coralloid, up to 1 mm long, 0.10-0.25

FIG. 3. *Stereocaulon sterile* (Sav.) M. Lamb. A fertile specimen from U.S.A., California (Thiers no. 15248). × 4.

mm diam., closely branched, and resembling those of *St. dactylophyllum* Flk. or *St. tennesseense* H. Magn., coarser than those of *St. subcoralloides* Nyl. No *soredia*. *Cephalodia* usually numerous and sometimes

quite conspicuous, laterally sessile on pseudopodetia, pulvinate-subglobose, 1-2 mm diam., brownish gray, brown or dark brown, with verruculose surface, resembling those of *St. subcoralloides* Nyl.; containing *Stigonema* or more rarely *Nostoc*. *Apothecia* very rare, borne on the ends of pseudopodetial branches, 1-3 mm diam., convex and

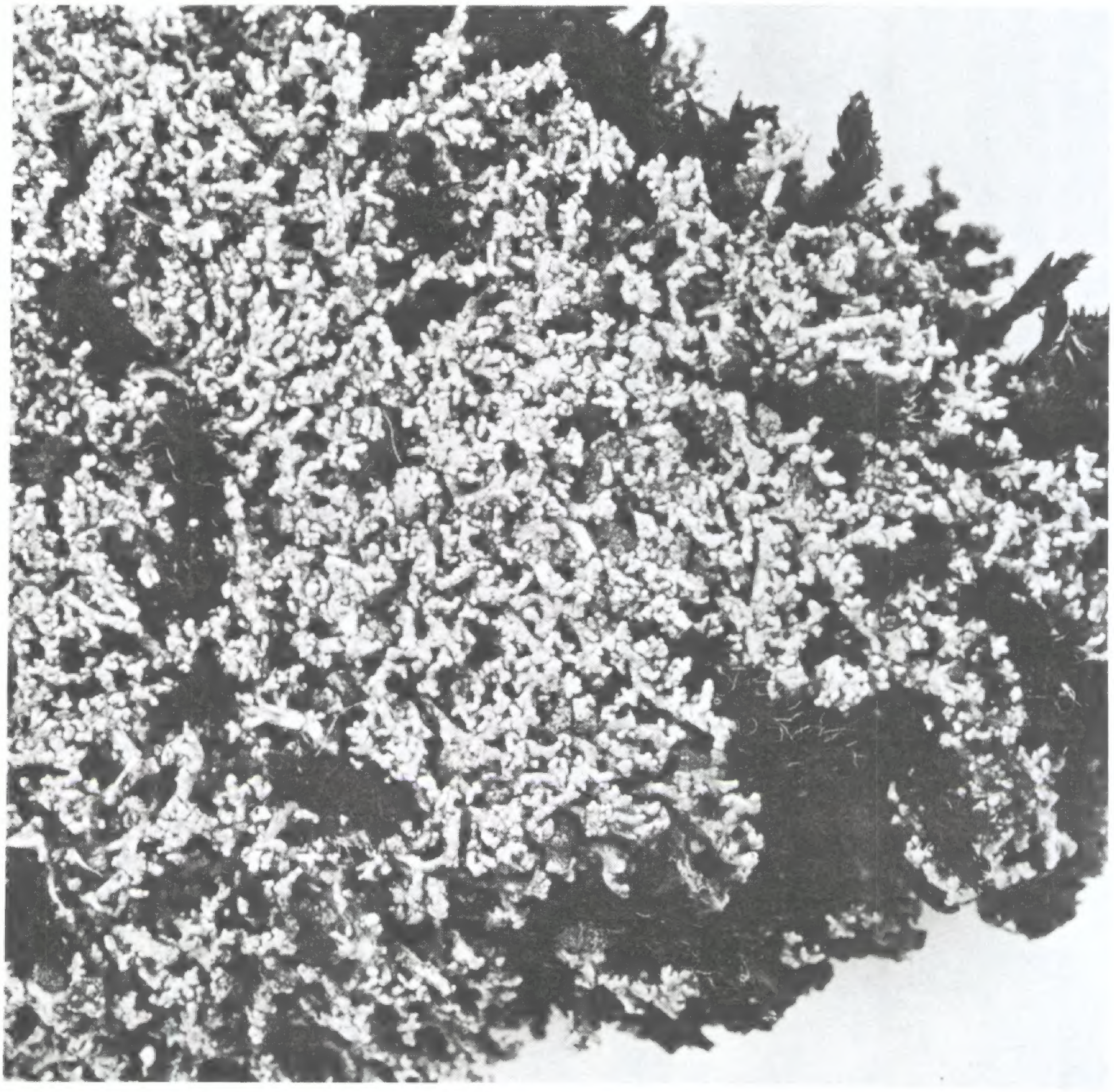


FIG. 4. *Stereocaulon sterile* (Sav.) M. Lamb. Part of a specimen from U.S.A., Oregon (Lamb no. 7750). × 5.

immarginate, often variously lobed, furrowed or tuberculate, dark brown to brown-blackish, finally sometimes divided into clusters of small, convex-immarginate, secondary discs. Young apothecia sometimes with a pale, non-prominent, pseudothalline margin, which soon becomes reflexed and evanescent. Excipulum reduced and indistinct, 45-75 μ thick, sordid brownish in section, composed of indistinct, conglutinated, gelatinized, ± parallel, thick-walled hyphae ± inspersed with sordid dull yellowish granules, only the narrow, tubular-fistulose lumina visible.

Central cone up to 500 μ deep, in younger apothecia colorless and clear, but in upper part sometimes with included aggregations of dark sordid yellowish granular substance; in older apothecia often isabelline-cloudy, $\pm$ opaque, and contrasting with the more hyaline hypothecium; of compact gelatinized structure with only the tubular lumina visible in the

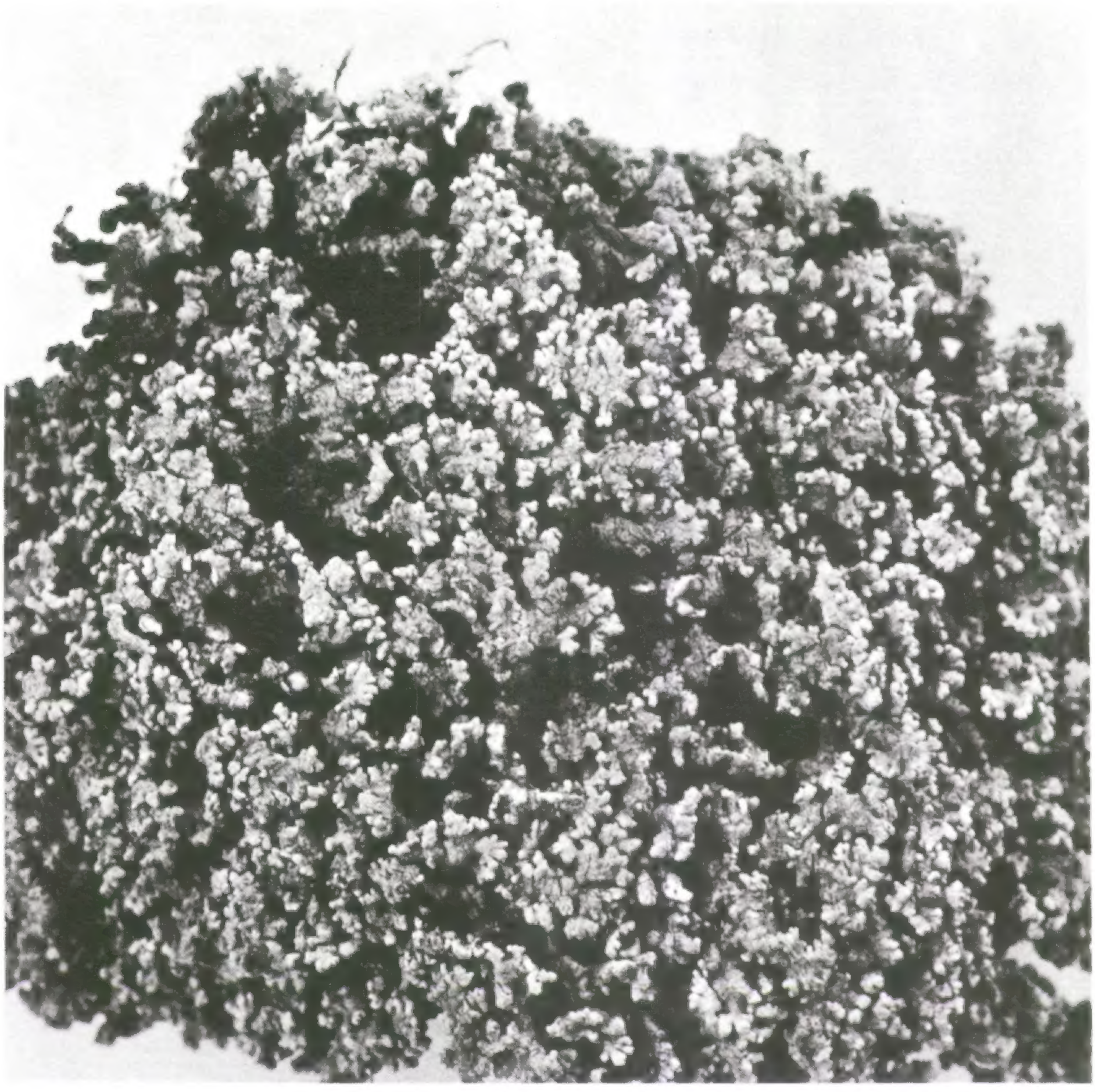


FIG. 5. *Stereocaulon sterile* (Sav.) M. Lamb. Specimen from U.S.A., Oregon (Lamb no. 7794) showing squamulose development of phyllocladia, resembling those of *St. evolutum* Graewe. × 5.

clear mucilaginous matrix. Hypothecium 30-70 μ deep, colorless or in thicker sections faintly isabelline, usually rather distinctly delimited from the underlying central cone tissue. Hymenium 50-75 μ high, brown in upper part. Paraphyses simple or furcate, 1.3-1.5 μ thick, pigmented and swollen to 4 μ at the tips. Asci (35-) 40-60 μ long. Spores 4-6 (-8) in ascus, straight or slightly curved, cylindric-fusiform, 3-4-septate (rarely 1- or 5-septate), 27-45 (-50) × 3.0-3.5 (-4.5) μ. (No *pycnidia* seen.)

Reactions and chemistry: phyllocladia K + yellow, PD + pale yellow.[1] Chromatographic tests were made on 3 specimens (from California and Oregon) by Messrs. C. FOX and S. HUNECK, and indicated the presence of atranorin and lobaric acid. The technical procedures involved are described by Huneck (1972, p. 1494).

St. sterile seems to be a fairly common species in the Pacific coastal region of North America from Alaska southwards to California, and

FIG. 6. *Stereocaulon sterile* (Sav.) M. Lamb. Fertile pseudopodetium from a specimen from U.S.A., Oregon (Pike no. 1381). × 3.

occurs also in Kamtchatka (Fig. 1). At present this appears to represent a very one-sided amphipacific distribution, but possibly the species will eventually be found in more southerly areas of the Far East Asiatic coastline, for example in Hokkaido and even northern Honshiu.

Our own field observations (in U.S.A., Oregon) show it characteristically to form rather small, isolated, pulvinate-caespitose clumps of compact growth firmly attached to rock (often serpentine) or to detritus

[1] K: a mixture of equal parts of 5 per cent potassium hydroxide (KOH) and 20 per cent potassium carbonate (K_2CO_3), both in aqueous solution. PD: paraphenylenediamine ($C_6H_4(NH_2)_2$), 5 per cent solution in 95 per cent alcohol, freshly made up for each occasion.

in the rock crevices, more rarely extending over mosses, at altitudes of 80 to 1535 m.

Lamb (1970, p. 222) mentioned *St. evolutum* f. *sterile* Sav., pointing out that on phytogeographical grounds the occurrence of *St. evolutum* in Kamtchatka would be unlikely, as it belongs to the European N. Atlantic oceanic element. At the time of writing the manuscript we had not yet seen any authentic specimens of f. *sterile*.

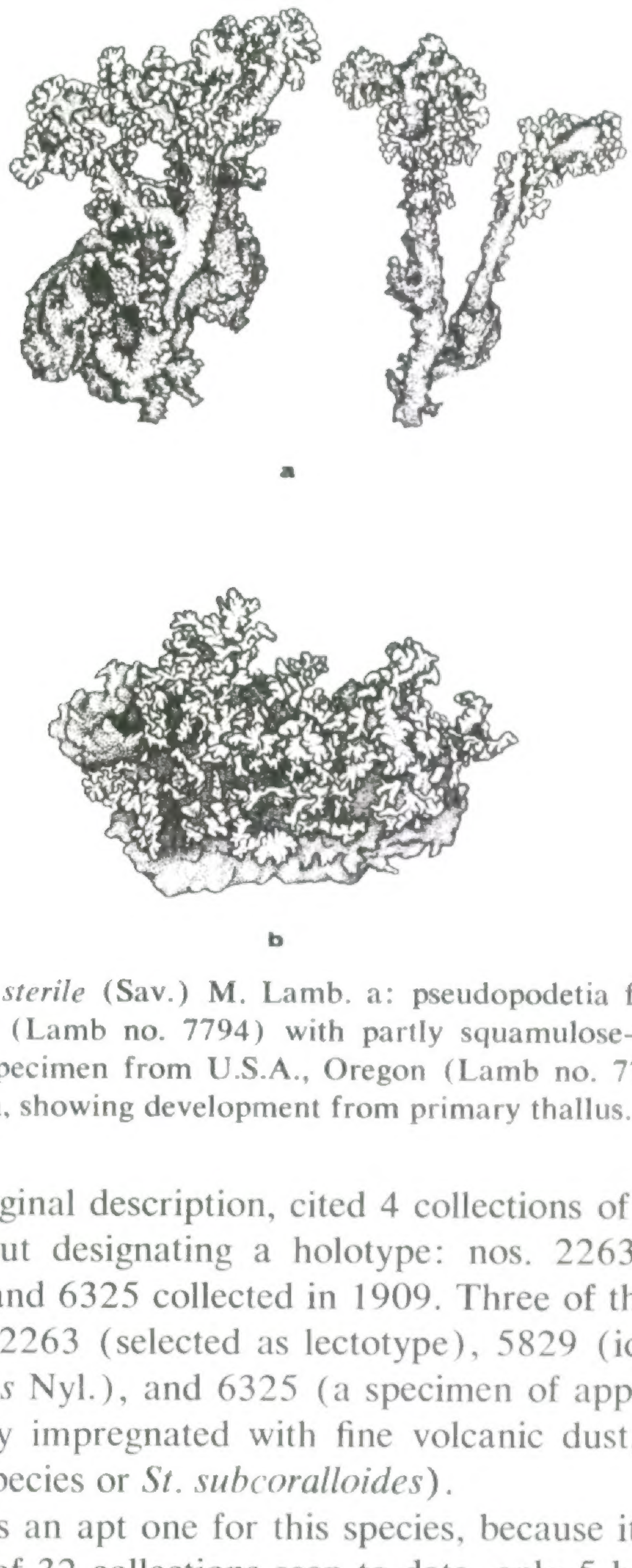


FIG. 7. *Stereocaulon sterile* (Sav.) M. Lamb. a: pseudopodetia from a specimen from U.S.A., Oregon (Lamb no. 7794) with partly squamulose-flattened phyllocladia. b: part of a specimen from U.S.A., Oregon (Lamb no. 7750) on detritus substratum, showing development from primary thallus. × 4.

Savicz, in his original description, cited 4 collections of f. *sterile* from Kamtchatka, without designating a holotype: nos. 2263, 5829, 5882 collected in 1908, and 6325 collected in 1909. Three of these have been seen by us in LE: 2263 (selected as lectotype), 5829 (identified by us as *St. subcoralloides* Nyl.), and 6325 (a specimen of apparently abnormal growth, heavily impregnated with fine volcanic dust, and possibly either the present species or *St. subcoralloides*).

Savicz's epithet is an apt one for this species, because it is most commonly sterile. Out of 32 collections seen to date, only 5 have apothecia.

The only other *Stereocaulon* species encountered in the same geographical area, with which *St. sterile* might be confused, are *St. subcoralloides* Nyl. and *St. intermedium* (Sav.) H. Magn., both of which differ in the constantly terete-coralloid (never flattened-squamulose) phyllocladia. Even specimens of *St. sterile* not showing the latter type of development can be distinguished from normal *St. subcoralloides* by the larger size of the dactylaeform-coralloid phyllocladia, and from *St. intermedium* by the smaller stature, darker cephalodia, and the very infrequent fertility, with smaller apothecia.

U.S.A., Alaska. South Central Alaska, Kenai Peninsula, Seward, altit. 30 m, H. Krog 1957 nos. 1904, 1924 (O), ster.; Portage Glacier, altit. 30 m, H. Krog 1957 no. 1917 (O), ster.; Richardson Highway, Mile 45, altit. 425-1060 m, H. Krog 1957 no. 1864 (O), ster.; Anchorage area, Rabbit Creek, altit. 243-606 m, H. Krog 1957 no. 1270 (O), ster.; Central Alaska, White Mts., Beaver Creek, E. of Sheep Creek, altit. 272 m, H. Krog 1953 no. 293 (O), ster.; South Eastern Alaska, Ketchikan, Ward Lake, altit. 30 m, H. Krog 1957 nos. 6129, 6130, 6131 (O), ster.; Western Alaska, Nunivak Island, Mekoryuk, H. Krog 1957 no. 2917 (O), ster. **Washington.** Clallam Co., Lake Crescent, Storm King Mountain, altit. 1000 m, A. H. Smith 1935 no. 2238 (FH), ster.; Storm King Mountain trail, on dry slope, L. H. Pike 1969 no. 939 (ORE), ster.; Mt. Ellinor, altit. 1000 m, A. S. Foster 1912 no. 2095 (FH), ster.; Skagit Co., S. slopes of Mt. Eric, 8 miles S. of Anacortes, in rock crevices, L. H. Pike 1969 no. 811 (ORE), ster.; Spokane (or Stevens) Co., Spokane River, Bowl and Pitcher, on basaltic talus slope, unknown collector 1907 s. n. (FH), ster. **Oregon.** Clatsop Co., Saddle Mountain, lower slopes, altit. 600 m, on agglomerate rocks forming an exposed bluff, I. M. Lamb 1957 no. 7744 (FH), ster.; near summit, altit. 1035 m, over moss on breccia block, I. M. Lamb 1957 no. 7735 (FH), ster.; Tillamook Co., summit of Mt. Hebo, altit. 1035 m, on steep exposed basaltic rocks, I. M. Lamb 1957 no. 7750 (FH), ster.[2]; Hood River Co., Columbia River Valley, Mitchell Point above Bonneville Dam, altit. 83 m, on basalt cliffs by roadside, I. M. Lamb 1957 no. 7794 (FH), ster.; Columbia River, Cascade Locks, barren rock slide facing river, P. B. Lawrence 1933 s. n. (WELC), ster.; Lane Co., Eugene, Spencer Butte, F. Sipe 1954 no. 1299 (ORE), ster.; Curry Co., Siskiyou Mts., S. ridge of Vulcan Peak, altit. 1535 m, on exposed metamorphic and serpentine outcrops, I. M. Lamb 1957 nos. 7828, 7852, 7854, 7855 (FH), ster.; Josephine Co., Store Gulch in Illinois Valley W. of Selma, altit. 382 m, on serpentine rock, L. H. Pike 1968 no. L-497 (ORE), ster.;

[2] Atranorin and lobaric acid demonstrated by chromatography.

3 miles W. of Store Gulch, altit. 460 m, on serpentine rocks, L. H. Pike 1969 no. L-645 (ORE), partly fert., 1970 no. 1381 (ORE), partly fert.[2] **California.** Del Norte Co., Smith River Road, E. of Gasquet, on bare vertical rock cliff, L. H. Pike 1969 no. 1163 (ORE), ster.; Humboldt Co., 16.8 miles N. of Willow Creek, R. Gankin 1966 s. n. (DAV.), ster.; Contra Costa Co., Pieta, M. A. Howe 1896 no. 801 (NY), ster.; Mt. Diablo, M. A. Howe 1896 s. n. (NY), ster.; San Mateo Co., San Francisco watershed, altit. 90 m, H. D. Thiers 1966 no. 15248 (SFSC), fert.[2]; Santa Cruz Co., Bonny Doon, P. Gardner and C. McMillan 1950 s. n. (UC), fert.

Canada, British Columbia. Near Vancouver, F. Perry 1920 s. n. (BM), sparingly fert.

U.S.S.R., Kamtchatka. Truby Volcano near Sel'dëvaya River, on rocks, V. P. Savicz 1908 no. 2263 (LECTOTYPUS) (LE), ster.

Stereocaulon groenlandicum (Dahl) M. Lamb, **n. comb.**

Syn. *St. rivulorum* var. *groenlandicum* Dahl, 1950, p. 117, pl. II, fig. 2.[3] Holotype material: S. W. Greenland, Julianehaab Distr., Igalikofjord, Igdlerfigssalik, coll. E. Dahl, 1937 (s. n.), in Herb. Bot. Mus. Oslo (O); isotypes in Herb. Bot. Mus. Copenhagen (C) and Herb. Smithsonian Institution (US).

A saxicolous or terricolous species apparently of circumpolar boreal-Arctic distribution, belonging to subgen. *Stereocaulon*, sect. *Stereocaulon*, most closely resembling *St. rivulorum* H. Magn., but differing morphologically in the firm, rigid and ligneous pseudopodetia like those of *St. botryosum* Ach. emend. Frey, and chemically in the typical presence of miriquidic acid, perlatolic acid, anziaic acid, and two unidentified substances (in *St. rivulorum* atranorin and lobaric acid are the typical constituents).

Fig. 8 (distribution); Figs. 9-11 (habitus).

Pseudopodetia erect or sometimes apparently ± prostrate and entangled, firmly attached to the substratum, rigid and woody (like those of *St. botryosum* Ach. emend. Frey), (1.5-) 2-4 (-5) cm high, 0.5-1.5 (-2.0) mm thick, terete, sparingly to moderately branched (sometimes mainly in upper parts, in a ± corymbose pattern), whitish to sordid bone-colored, matt, decorticate, smooth or sometimes longitudinally striate, glabrous or with a distinct, thin, adpressed, felted, pale tomentum; occasionally brown- or ferruginous-tinged at and near the base. *Phyllocladia* lateral on pseudopodetia, scattered or crowded, usually

[3] Direct basionym reference: *Stereocaulon rivulorum* var. *groenlandicum* Dahl in Medd. om Grønland, 150, p. 117. 1950.

more abundant in upper parts, the lower parts being often ± bare of phyllocladia; distributed on all sides of pseudopodetia or sometimes mainly on one side only (slight to marked dorsiventrality); whitish, at

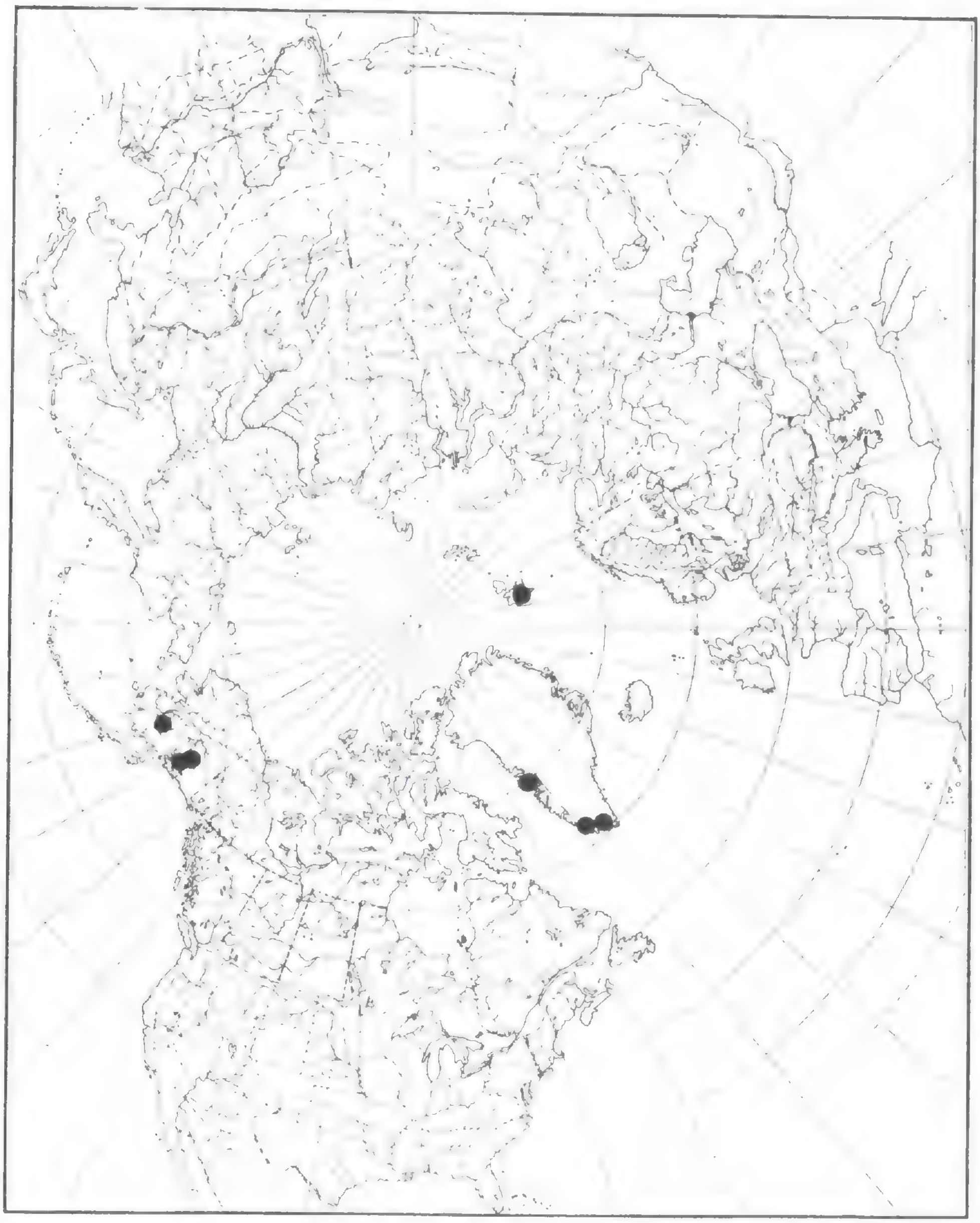


FIG. 8. Known distribution of *Stereocaulon groenlandicum* (Dahl) M. Lamb.

first grain-like, soon becoming thickly crenate- or digitate-squamuliform, occasionally lobed and branching, strongly resembling those of *St. rivulorum* H. Magn.; 0.2-0.8 mm diam., or up to 1.5 mm if lobed and branching. No *soredia*. *Cephalodia* not abundant and usually inconspicu-

ous, sometimes apparently absent, laterally sessile on pseudopodetia among phyllocladia; rather variable in appearance; forming irregularly subglobular masses 0.5-0.8 mm diam., occasionally aeruginose but more often sordid yellowish or pale brownish and sometimes semipellucid, not distinctly botryose; sometimes, when optimally developed, pale brown, vaguely tuberculate with the component portions often with a single, slightly depressed, darker spot (resembling those of *St. rivulorum* H. Magn.); containing *Nostoc* in the specimens examined. *Apothecia* fairly frequent (present in 8 out of the 12 specimens seen to date), terminal,

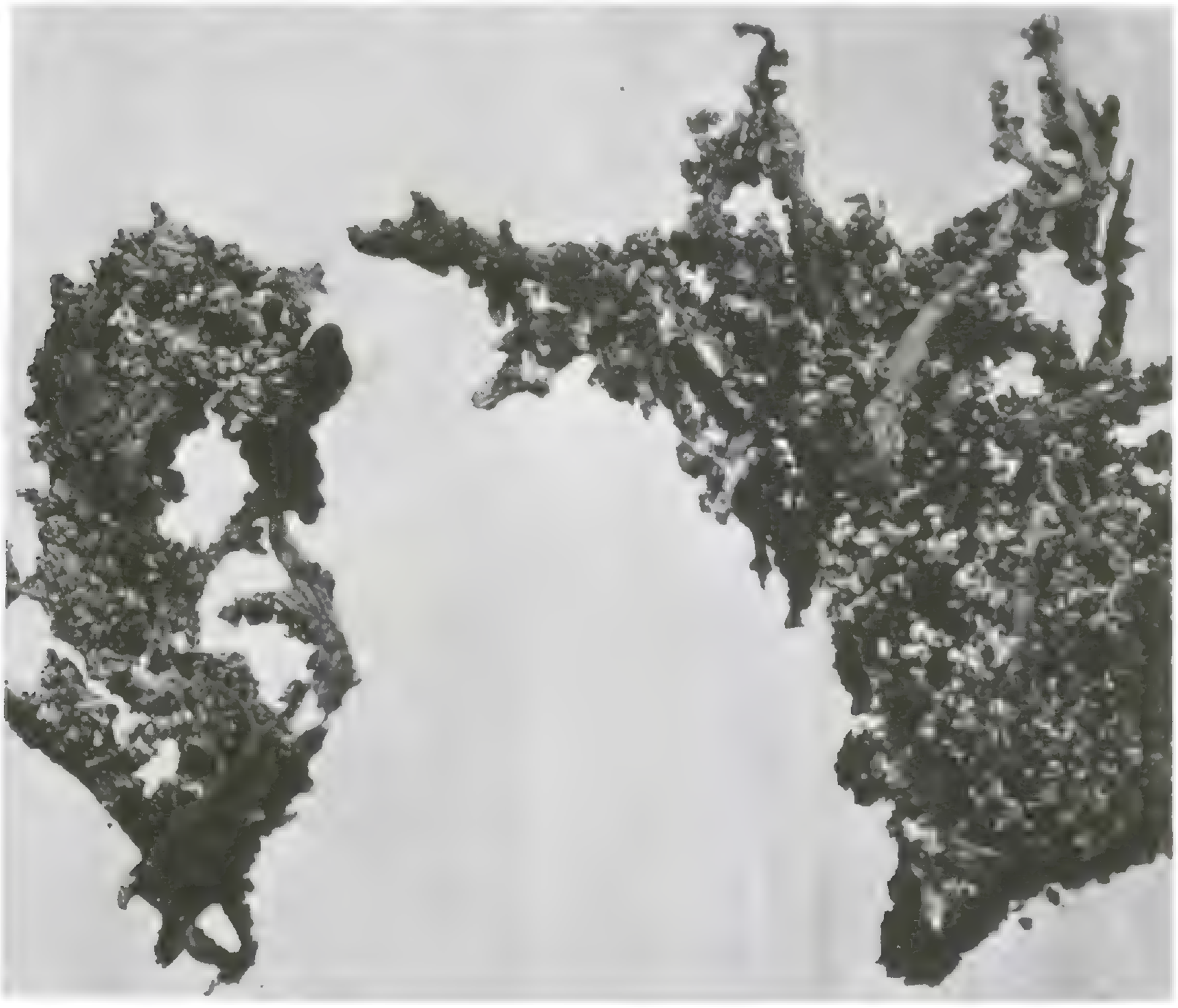


FIG. 9. *Stereocaulon groenlandicum* (Dahl) M. Lamb. An isotype specimen from Greenland, coll. E. Dahl, 1937, in Herb. Bot. Mus. Copenhagen. × 3.

mostly soon becoming convex and immarginate, dark brown to brown-blackish, smooth, matt, finally large (3-6 mm diam.) and then undergoing cleavage to form compound masses of convex immarginate discs each 0.8-1.5 mm diam. borne on corymbosely divided terminal branches. Youngest stages (0.5-1.5 mm diam.) plane-scutelliform to slightly convex with a thin to moderate, entire, slightly prominent, dark or paler (pale brown) proper margin. Excipulum present only in young, ± plane apothecia, absent in more developed, convex-immarginate discs; developed at sides, indistinct to evanescent further down; 60-90 μ thick,

pale red-brown pigmented in section, of conglutinate, palisadic-radiate structure with only the tubular lumina visible. Central cone colorless, hyaline, without air-spaces or inclusions, consisting of a clear gelatinous matrix in which the interlacing, fistulose-tubular hyphal lumina, about 1 μ wide, are distinctly visible. Hypothecium (40-) 50-75 μ deep, but transitional without sharp limit into central cone tissue below; colorless and clear to faintly isabelline-cloudy (depending on thickness of sections), composed of fine, densely intertexted hyphae. Hymenium 50-75 μ high, with asci 50-60 μ long. Spores 4-8 in ascus, elongate-fusiform, straight, 3-septate, (20-) 33-40 × 3-4 μ. (No *pycnidia* found.)

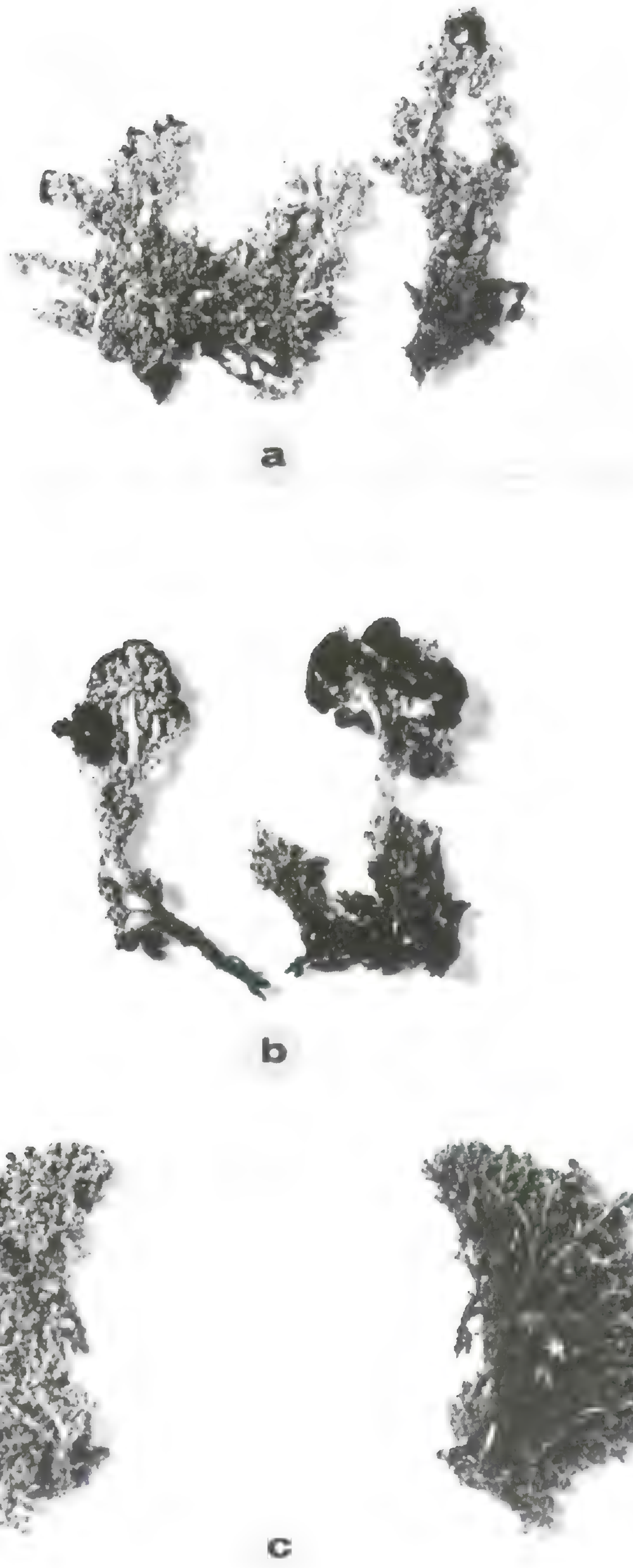
Reactions and chemistry: phyllocladia K + yellow, PD + pale yellow.[4] Three specimens (1 from Greenland, 2 from Alaska) were studied chromatographically by Dr. Chicita Culberson and found to contain atranorin, miriquidic acid, lesser amounts of perlatolic acid and anziaic acid, and 2 unidentified substances. Exactly similar chromatograms were obtained by Dr. H. Krog for the type specimen from Greenland in the Oslo Botanical Museum and for an Alaskan specimen collected by L. A. Viereck. One specimen, from Spitsbergen, collected by the Turku University Expedition of 1966, was found by Dr. Culberson to contain atranorin only; its habitus and morphology however are so typical of *St. groenlandicum* that it seems safe to regard it as an acid-deficient phase of the species. Miriquidic acid is a depside recently described by Huneck, Schreiber, Snatzke and Fehlhaber (1971) from two *Lecidea* species.

Stereocaulon groenlandicum is known at present from W. and S.W. Greenland, southern Alaska and Spitsbergen, and hence seems to have a boreal-Arctic circumpolar distribution (Fig. 8). As mentioned above, the specimen seen from Spitsbergen appears to represent a deficient chemical phase of the species, which may be explainable by its much more northerly location.

Not having ever seen this species in nature, we are unable to give any firsthand information on its habitus, mode of growth, or ecology, but from the available collectors' notes it grows on rocks or on gravelly soil from probably near sea level up to about 800 m s. m. (in Greenland) and from 460 to 1500 m s. m. (in Alaska), and judging by the small number of specimens collected, does not appear to be common.

Dahl, who first collected and described the taxon, referred it to *St. rivulorum* H. Magn., at the same time pointing out that it is unlike that species in general appearance, and when occurring together with the typical *St. rivulorum* could easily be distinguished from the latter. He considered it probable that it ought to be regarded as a separate species. The robust woody pseudopodetia resemble those of *St. botryosum* Ach.

[4] See footnote on p. 7.



a

b

c

FIG. 10. *Stereocaulon groenlandicum* (Dahl) M. Lamb. a: a specimen from U.S.A., Alaska (Viereck no. 5273). b: a specimen from U.S.A., Alaska (Krog no. 1285) with copious development of large apothecia. c: a specimen of dorsiventral habitus from U.S.A., Alaska (Krog no. 1279), upper and lower sides. × 1.

emend. Frey or sturdy states of *St. vesuvianum* var. *nodulosum* (Wallr.) M. Lamb (syn. *St. denudatum* Flk.), and the phyllocladia in the crenate-squamuliform condition are like those of *St. alpinum* Laur., while those developing further into a branching-lobate state are very similar to those of *St. rivulorum* H. Magn. In spite of the resemblance of well developed digitate-lobate phyllocladia to those of *St. rivulorum,* these appear to be all derived from thallus-mantle phyllocladia of the *alpinum*-type, whereas in *St. rivulorum,* when typically developed, some or most of the phyllocladia are actually modified terminal pseudopodetial branchlets. The finally very large apothecia are of the same type as occur in *St.*

FIG. 11. *Stereocaulon groenlandicum* (Dahl) M. Lamb. Apex of a fertile pseudopodetium from a specimen from U.S.A., Alaska (Viereck no. 5273). × 4.

rivulorum. Morphologically, the closest affinity of *St. groenlandicum* is obviously with *St. rivulorum,* but its chemical constituents (atranorin, miriquidic acid, perlatolic acid, anziaic acid) are those characteristic of *St. capitellatum* H. Magn. and *St. farinaceum* H. Magn., two rather rare species occurring in Scandinavia, Central Europe, and Greenland; both of these are sorediate, and do not appear to be closely related to *St. groenlandicum*.

Greenland. South West Greenland, Julianehaab Distr., Igalikofjord, Igdlerfigssalik, altit. 700-800 m, E. Dahl 1937 s. n. (HOLOTYPUS) (O), fert.[5], (ISOTYPUS) (C), fert., (ISOTYPUS) (US), ster.;

[5] Atranorin, miriquidic acid, perlatolic acid and anziaic acid demonstrated by chromatography.

Sermilik, Tasiussaq, E. Dahl 1937 s. n. (C), ster.; Lichtenaufjord, Qagdlimiut, E. Dahl 1937 s. n. (C), ster.; Igaliko, "in montibus altissimis", J. Vahl 1828 s. n. (C), fert.; West Greenland, Frederikshaab Distr., Ivigtut, Guldfjeldet, altit. 125 m, on rocks, M. Skytte Christiansen 1946 no. 113 (C), ster.[5], altit. 450 m, "on open, very exposed, gravelly soil", M. Skytte Christiansen 1946 no. 265 (C, O), ster.; Godhavn Distr., Disko Island, Godhavn, J. Vahl n. d., s. n. (C), fert.

U.S.A., Alaska. South Central Alaska, Richardson Highway, Mile 45, altit, 425-1060 m, H. Krog 1957 no. 1910 (O), fert.[5]; Talkeetna Mts., Bald Mountain Ridge, altit. 1363 m, H. Krog. 1957 no. 1279 (O), fert., no. 1285 (O), fert.[5]; Alaska Range Distr., upper valley of Swift Fork of Kuskokwim River, altit. 880 m, on rocks on dry S.-facing rocky slope, L. A. Viereck 1961 no. 5273 (ALA, FH, O), fert.[5]

Svalbard. West Spitsbergen, Isfjorden, peninsula W. of Grønfjorden, on rock, University of Turku Spitsbergen Exped. 1966, 1966 s.n. (TUR), fert.[6]

Acknowledgements

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[6] Atranorin only demonstrated by chromatography.

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